

Soil Survey of Madison County.

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LOCATION AND BOUNDARIES OF THE AREA.

Madison County is located in the central part of Indiana, north-east of Indianapolis. The county is a rectangle, with a width

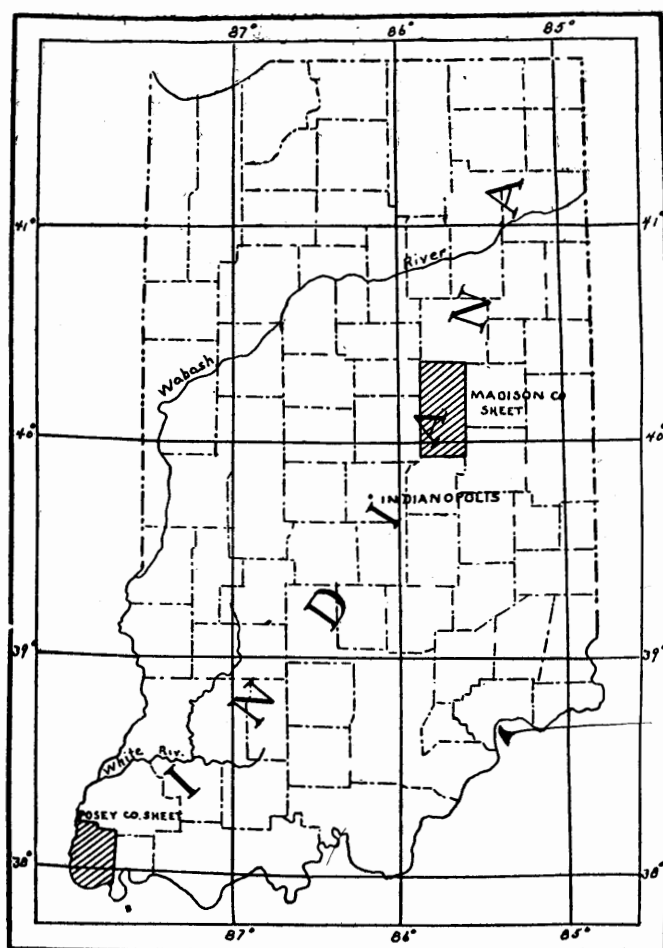


FIG. 1.—Sketch map showing position of the Madison County area, Indiana.

east and west of 15 miles and a length north and south of 30 miles, comprising an area of 450 square miles. It is bounded on the north by Grant County, on the east by Delaware and Henry counties, on the south by Hancock County, and on the west by Hamilton and Tipton counties.

CLIMATE.

In the area surveyed the climatic conditions are about the same as the average mean temperature and precipitation for the State. The following table is taken from the report (1903) of the Weather Bureau Station at Anderson, near the center of Madison County:

NORMAL MONTHLY AND ANNUAL TEMPERATURE AND PRECIPITATION.

MONTH.	Anderson.		MONTH.	Anderson.	
	Temper- ature.	Precipi- tation.		Temper- ature.	Precipi- tation.
	°F.	Inches.		°F.	Inches.
January.....	29.3	2.37	August.....	74.0	4.15
February.....	27.9	1.97	September.....	67.5	2.75
March.....	38.4	4.02	October.....	55.6	2.08
April.....	51.9	2.68	November.....	41.9	3.98
May.....	62.5	3.49	December.....	30.7	2.65
June.....	71.6	2.86			
July.....	75.2	3.89	Year.....	52.2	36.89

The records at Anderson for the past several years show the average dates of the last killing frost in spring and the first killing frost in fall to be April 18 and October 19, respectively.

PHYSIOGRAPHY AND GEOLOGY.

Madison County has an average elevation of about 800 feet above sea level. The surface features in general consist of a gently undulating plain, with broad, level, interstream areas more or less rolling as they near the water courses.

A belt about 3 miles wide, with the features of a dissected ridge and consisting of a heterogeneous mass of boulders, sands, and gravels typical of glaciated regions, occurs along Kilbuck Creek. It passes through Anderson, following the southeast side of Prairie Creek, and extending to Lick Creek, 3 miles southwest of Pendleton, and is cut by White River, just north of Anderson.

The meandering of White River has built up two distinct terraces, the higher terrace being bordered by rounded bluffs of low elevation, while along the smaller streams are usually found narrow overflow bottoms. With the exception of Kilbuck, Fall, and

Lick creeks, the streams flow in shallow channels, sloping gradually to the uplands.

The north fork of White River, which flows slightly north of west through the county, receives the greater part of the drainage waters beyond the county line. Pipe Creek rises in Delaware County, flows southwest, and empties in to White River about a mile beyond the western boundary, draining the northern and northeastern parts of the area surveyed. Kilbuck Creek rises in Delaware County and drains the eastern part of Madison County, flowing into the White River near Anderson. Duck Creek rises on the "Black Flats," flows southwest through Elwood, and empties into White River in Hamilton County. This creek is nothing more than a series of public drainage ditches, converging into one main ditch, constructed for the better drainage of what was once a great marsh. Fall Creek and Lick Creek flow in nearly parallel courses, coming together in the extreme southwestern part of the county, and there emptying into the White River. The area between these two creeks is more rolling than the northern uplands. The country drainage passes by way of White, Wabash, Ohio, and Mississippi rivers to the Gulf of Mexico.

The underlying rocks in Madison County,¹ as exposed along streams that have cut through the glacial drift, belong to the Silurian and Devonian rock systems. The Upper Silurian occupies the eastern and northern parts of the county, and is represented only by the Niagara group. The limestones of this series occur at several points along White River in its course through the county, and are overlain in most places by soft, crumbly shales. It has also been exposed along Prairie Creek, about 2 miles south of Anderson, and outcrops also in several places along Pipe Creek.

The Devonian strata, consisting of the Corniferous limestones and Oriskany sandstones, underlie the glacial drift in the southwestern corner of the county, embracing all of Green Township and parts of Fall Creek and Stony Creek townships. The largest and boldest outcrop in the county occurs at the falls near Pendleton, where the rock, which is a sandstone said to be closely related to the Oriskany, is exposed. The calciferous strata of the Oriskany series appears in the stream bed a mile above Pendleton, on Fall Creek. It also outcrops near the Hamilton County line, near Fishersburg. The Corniferous limestone, the upper member of the Upper Silurian in this county, outcrops at Fosters Branch, 4 miles

¹ Facts relating to the geology of Madison County are drawn largely from the report of the Indiana State Survey, 1884, by Ryland T. Brown.

below Pendleton, at a point near the county line. The rock at this point is a compact, crystalline limestone, and makes good foundation stone.

The underlying rocks of Madison County have such a limited exposure as to have little influence on the soils. The greater part of the county is covered with a deep deposit of glacial drift, laid down during the advance and retreat of the ice sheet. A belt extending from the northeast corner of Richland Township to Anderson, and thence down the valley of Prairie Creek past Pendleton to the southern boundary of the county, covers a region of eroded valleys bordered by hills of washed gravel. This gravel was deposited by streams beneath the melting glacier, the finer sediments being carried on to form the surfaces of areas to the south. The southeastern side of the glacial river bed, which stretches from White River to Fall Creek, along what is now known as Prairie Creek, is bordered by a distinct lateral moraine, composed largely of gravel and boulders. This moraine often reaches a height of 40 or 50 feet above the level of the old river bed.

This valley of erosion is about a mile in width, and is depressed about 30 feet below the general surface of the county. The valley crosses Fall Creek, and narrows as it approaches Lick Creek near the Hancock County line. At the point where it crosses Fall Creek the surface is profusely strewn with boulders of granite, gneiss, and trap rock. Southeast of this ancient valley gravel hills are very numerous, but these are usually covered with a deposit of clay loam. North and west gravel beds are rare, and entirely disappear as the northern county line is approached.

SOILS.

The soils of Madison County are largely made up of clay loam, with smaller areas of muck and sandy loam. Altogether there are four types of soil, exclusive of Meadow.

The following table gives the extent of each of these types and the part which each forms of the whole area:

AREAS OF DIFFERENT SOILS.

Soil.	Acres.	Per cent.
Miami clay loam.....	232,640	83.6
Miami black clay loam.....	31,360	11.3
Meadow.....	10,816	3.9
Madison loam.....	2,240	.8
Muck.....	1,152	.4
Total.....	278,208

MIAMI CLAY LOAM.

The Miami clay loam consists of a loam or silty loam varying in depth from 6 to 12 inches, grading into a clay or clay loam of a stiff, heavy character which has a depth of 3 feet or more, and is, in turn, underlain by gravel or gravelly clay. The color of the soil varies from light to dark gray, although the lighter color is more general, while the subsoil is of a dark-yellow or mottled color, becoming lighter as it approaches the underlying gravelly clay.

The depth of the material from which the soil is derived is variable. Near Pendleton the underlying rock is only about 3 feet below the surface, but in general, between the subsoil and the rock there are strata of gravelly and boulder clays. In the subsoil, at depths varying from 12 to 36 inches, are found in a number of places pockets of cross-bedded gravels and sands. Where these occur near the surface they have resulted in a phase of the Miami clay loam which can be described as a gravelly loam, underlain by a gravelly clay or gravel. This phase occurs in very narrow streaks, rarely exceeding a width of 40 feet, particularly along the river bluffs and the watersheds of the larger streams, and is the result of general surface washing and erosion. The proximity of such pockets to the surface causes a more or less droughty condition of the soil. The more important of these areas are indicated on the map by the gravel symbol.

The Miami clay loam occupies about 83 per cent of the entire area of the county, and extends for many miles beyond the limits of the present survey. It occurs with remarkable uniformity in different parts of the county, with the exception of such changes as attend the varying drainage conditions of local areas.

The surface features of this type are gently rolling, becoming more rolling and broken as it approaches the water courses.

The Miami clay loam is derived from the mantle of drift which was laid down subsequent to the deposition of the boulder clay in the waters in front of the great ice sheet during its recession. Over the type occurs a scattering of erratic boulders, supposed to have been brought from remote regions by the agency of icebergs. These erratics are not so numerous as to interfere with cultivation.

At the time of the early settlements the Miami clay loam was generally in a poorly drained condition. Tiling and surface ditching have done much to improve its condition, although at present there are many small areas of local importance—particularly in the large, level, interstream areas—which are badly in need of more perfect drainage.

The original timber growth on this type consisted of oak, ash, hickory, elm, beech, and sugar maple. These forests have gradually disappeared, and now only a few scattered woodlots are encountered.

The soil of the Miami clay loam is easy to cultivate; the subsoil, upon drying, breaks up into small cubes, the soil becomes loose and friable, and is a very productive soil type. It is used for general farming purposes, producing chiefly such crops as corn, wheat, oats, and grass. Some garden truck is grown, and orcharding is also carried on to some extent. No system of crop rotation is generally followed. Corn may be grown one or more years in the same field, then wheat or oats, followed by grass for two years. The fields are then left in pasture for a period of three or four years. Many farmers sow corn continuously for four or five years, and follow it with wheat for about the same number of seasons. This is in turn followed by timothy and clover, which run two years, and the fields are then used for pasturage for indefinite periods.

In good seasons the average yields of the field crops are given as follows: Corn 60 bushels, wheat 20 bushels, oats from 15 to 40 bushels, and hay from 1 ton to 1½ tons to the acre.

Orchards are few in number, and the acreage in tree fruits could be profitably increased. Apple and pear trees and grape vines were found to be of good growth and thrifty where the soil was well drained.

Mechanical analyses of the fine earth of the soil and subsoil of this type are given in the following table:

MECHANICAL ANALYSES OF MIAMI CLAY LOAM.

No.	LOCALITY.	DESCRIPTION.	Organic matter.	Gravel, 2 to 1 mm., Per Cent.	Coarse Sand, 1 to 0.5 mm., Per Cent.	Medium Sand, 0.5 to 0.25 mm., Per Cent.	Fine Sand, 0.25 to 0.1 mm., Per Cent.	Very Fine Sand, 0.1 to 0.05 mm., Per Cent.	Silt, 0.05 to 0.005 mm., per cent.	Clay, 0.005 to 0.0001 mm., Per Cent.
9462	3 miles NE of Anderson.	Silty loam, 0 to 12 inches.	1.46	0.96	1.88	2.12	7.60	7.54	59.86	19.90
9464	6 miles W. of An- derson.	Silty loam, 0 to 11 inches.	2.38	.70	2.50	2.46	6.54	5.70	59.50	22.30
9466	3 miles SW. of Alexandria.	Loam, 0 to 8 inches.	2.80	.88	2.48	4.62	23.22	10.30	35.80	22.66
9467	Subsoil of 9466...	Stiff clay loam, 8 to 36 inches.	2.58	.58	1.86	2.94	21.30	12.82	36.12	24.30
9465	Subsoil of 9464...	Stiff clay loam, 11 to 36 inches.	.75	Tr.	1.34	1.78	5.82	6.36	59.90	24.90
9463	Subsoil of 9462...	Stiff clay, 12 to 36 inches.	.52	.60	2.24	2.24	9.50	8.52	47.62	29.36

MIAMI BLACK CLAY LOAM.

The Miami black clay loam consists of a clay loam having a depth of 10 inches, grading into a stiff, silty clay.

When wet this type has a characteristic dark-gray or black color, which, as the soil dries, turns to an ashy gray. The immediate subsoil is very darkly mottled, but at depths exceeding 24 inches it generally becomes lighter, assuming the same color as the subsoil of the Miami clay loam.

The Miami black clay loam occupies slightly more than 11 per cent of the area of the entire county. It is found in a large tract of irregular outline in the northwestern corner of the county, in the vicinity of Elwood. Another area is found along the northern county line, in Boone Township, while a few isolated areas occur east of Alexandria. There are also many areas too small to map, occurring in depressions throughout the Miami clay loam.

The level or troughlike depressions occupied by the Miami black clay loam were formed upon the recession of the great ice sheet at the close of the glacial epoch. These lands became swamps or ponds, and to the later accumulation of decaying vegetable matter with the wash from surrounding soils is attributed the formation of this type.

In its natural condition the Miami black clay loam is wet and cold, the result of imperfectly established drainage. The greater part of the type originally swampy has been completely or partially reclaimed by the use of tile and surface ditches, but there are still considerable areas that could be reclaimed in this way. This type is usually difficult to till. It breaks up into clods and the surface becomes cracked and broken during hot weather. Where the drainage is good and the soil receives the necessary care and attention, it is slightly more productive than the Miami clay loam.

Like the Miami clay loam, this soil is used for general farming purposes, largely for the production of corn, wheat, oats, and grass. Corn yields about 60 bushels, oats about 50 bushels, wheat from 15 to 20 bushels, and hay from $1\frac{1}{2}$ to 2 tons to the acre.

The lack of definite methods of crop rotation is as marked on this type as on the Miami clay loam.

The following table gives mechanical analyses of samples of the soil and subsoil of this type:

MECHANICAL ANALYSES OF MIAMI BLACK CLAY LOAM.

No.	LOCALITY.	DESCRIPTION.	Organic matter. Per Cent.	Gravel, 2 to 1 mm., Per Cent.	Coarse Sand, 1 to 0.5 mm., Per Cent.	Medium Sand, 0.5 to 0.25 mm., Per Cent.	Fine Sand, 0.25 to 0.1 mm., Per Cent.	Very fine Sand, 0.1 to 0.05 mm., Per Cent.	Silt, 0.05 to 0.005 mm., Per Cent.	Clay, 0.005 to 0.0001 mm., Per Cent.
9448	6 miles NE. of Elwood.	Clay loam, 0 to 8 inches.	5.56	0.40	1.50	2.00	7.88	12.12	56.82	18.40
9480	4 miles SE. of Elwood.	Black clay loam, 0 to 11 inches.	3.93	.86	3.18	3.76	11.68	9.92	48.96	21.50
9481	Subsoil of 9480...	Stiff silty clay, 11 to 36 inches.	.78	.72	1.78	1.86	6.16	7.08	59.16	23.24
9479	Subsoil of 9478...	Stiff silty clay; 8 to 36 inches.	2.75	.32	1.62	1.64	5.54	7.78	57.10	25.88

MADISON LOAM.

The Madison loam consists of loose, friable, brown or yellow loam or fine sandy loam, from 8 to 14 inches deep, resting upon a heavy loam or clay, which usually becomes heavier below 24 inches.

The lighter variations in this type are usually found as it approaches the water courses, while the heavier phases occur near the uplands. Throughout the soil and subsoil is a scattering of well-rounded gravel, while many local variations occur in the subsoil, which sometimes consists of alternating layers of sand and clay, with an occasional lens of cherty gravel.

The Madison loam has a very limited distribution in the area surveyed, occupying less than 1 per cent. of the area of the county. It occurs in the second bottoms. The surface features are level or slightly inclined toward the water courses. The type is an alluvial deposit, laid down by the river and stream when they flowed at much higher levels than at present. The soil materials are derived from the wash and erosion of the valley slopes, and the differences in texture are the result of the varying velocity of the water currents in which the deposition took place. The Madison loam is poorly drained in places, owing to seepage of the drainage from the hills through the gravel strata in the river and stream bluffs.

The soil is used largely for the production of corn, wheat, grass, and truck. It yields good crops of corn and hay, but poor crops of wheat. In the vicinity of Anderson it is used more largely for the production of truck. Cabbage, tomatoes, and all kinds of berries do well on this soil, and it is even better adapted to potatoes and the root crops.

The following table gives mechanical analyses of samples of the fine earth of the soil and subsoil of this type:

MECHANICAL ANALYSES OF MADISON LOAM.

No.	LOCALITY.	DESCRIPTION.	Organic matter. Per Cent.	Gravel, 2 to 1 mm., Per Cent.	Coarse Sand, 1 to 0.5 mm., Per Cent.	Medium Sand, 0.5 to 0.25 mm., Per Cent.	Fine Sand, 0.25 to 0.1 mm., Per Cent.	Very Fine Sand, 0.1 to 0.05 mm., Per Cent.	Silt, 0.05 to 0.005 mm., Per Cent.	Clay, 0.005 to 0.0001 mm., Per Cent.
9484	.1 mile W. of Anderson.	Light loam, 0 to 18 inches.	5.10	0.52	2.64	2.36	9.78	12.70	44.60	26.70
9482	2 miles N. of Anderson.	Fine sandy loam, 0 to 18 inches.	1.33	1.40	4.60	4.44	17.00	11.12	34.14	27.30
9483	Subsoil of 9482...	Loam, 18 to 36 inches.	1.16	1.08	3.80	3.70	14.80	10.36	42.60	23.60
9485	Subsoil of 9484...	Loam, 16 to 36 inches.	3.59	.70	2.34	2.48	16.06	17.16	36.48	24.60

MUCK.

Muck is a term given to that class of soils known as cumulose deposits, in which organic matter in various degrees of decomposition is the dominant characteristic.

The largest area of such deposits in this survey, and the one chiefly described, lies along the county drainage ditch between Anderson and Pendleton, east of the turnpike and the Cleveland, Cincinnati, Chicago, and St. Louis Railroad. The type also occurs throughout the county in many isolated areas of insignificant extent.

The soil is usually of a black color, less often a rich brown, and contains very little material other than organic matter. The depth of the deposit is variable, ranging anywhere from 8 to 36 inches, although exceptional spots occur where it exceeds a depth of 5 feet. There is a gradual change in the color and texture of the material as the depth increases, the black giving way to a yellowish-brown where the deposit has been subjected to but little oxidation, the tissues of the mosses and grasses being very plainly seen. Beneath this mass of partially decomposed vegetation there is a deposit of blue clay, of a stiff, heavy character, practically impervious to water. Interbedded with this are thin layers of lime marl, which rarely exceed 1 foot in thickness. No layers occur near the surface, although one boring showed indications of such a deposit at a depth of 8 feet.

The muck areas generally occupy poorly drained depressions, and are supposed to have been at one time shallow lakes or ponds. The depressions were first taken by aquatic vegetation of swimming types, followed by water ferns, coarse sedges, heaths, and sphagnum mosses, with willow, alder, and birch around the edges.

The area along the Pendleton ditch is troughlike and is supposed to have been a glacial river bed, which afterwards became a swamp through obstructed drainage. A portion of this swamp adjoining this area shows the condition of this type at an earlier stage of its development.

In the Pendleton ditch area drainage conditions vary considerably. In the southern part, where the deposit is narrow and the slopes steeper, the type is fairly well drained, but in the northern part it is imperfectly drained. In this section the main drainage ditches should be lowered and the number of laterals increased. The main can be lowered sufficiently for all practical purposes just below the McCulluch tract, or, if a greater fall is desired, the cut could be deepened at Pendleton Falls. This type, where cropped at all, is used for the production of corn and grass, and a little truck. The first two grow luxuriantly where perfect drainage has been established.

During the survey numerous local spots were seen, throughout the areas of high water table where corn had been killed. When the surface of these spots dried after a rain they were usually characterized by the formation of a very thin white crust.

Samples of this soil taken from a corn field near Anderson were collected by Prof. F. H. King, who made analyses of the water-soluble constituents dissolved by treating 100 grams of soil with 500 cubic centimeters of water. The results are given in the following table:

CHEMICAL ANALYSES OF THE WATER-SOLUBLE CONSTITUENTS OF MUCK.
[Parts per 1,000,000.]

	K.	Ca.	MgS.	NO ₃ .	HPO ₄ .	SO ₄ .	HCO ₃ .	Cl.	SiO ₂ .
Under poor corn.....	46.18	306.0	93.84	519.20	12.8	520.0	114.0	30.0	50.8
Under good corn.....	60.96	160.0	65.28	354.40	32.0	178.0	124.0	44.0	98.9
Corn killed.....	29.84	160.0	46.92	52.60	20.0	240.0	282.0	16.0	59.7

The figures show the largest amounts of potassium and phosphoric acid under the good corn, but this fact probably has no especial significance, since the amounts of all the essential plant-food constituents (presumably in a readily available, because readily soluble, form) are in excess of what is known from experience to be sufficient for cultivable crops. Indeed, the figures show that the soluble salts are present in sufficient quantity to prove dangerous to many crops, and this warning is the more important because of the white crust sometimes observed on the surface of this soil after a prolonged drought. The soil from the spot where the corn was

killed does not contain quite as much soluble material as the other spots show, and it seems that other causes were operative there, probably the rank growth of weeds observed when the sample was taken. It is obvious that it will be essential to the development of this type for cropping purposes that the water table should be lowered to 3.5 or 4 feet below the surface. For this purpose tile drainage is preferable. Similar soils have been profitably treated in this way in Illinois, Wisconsin, Michigan, and other areas of Indiana. A very instructive and detailed bulletin¹ on the treatment of such soils has been issued by the Indiana State Experiment Station. A description of the successful handling of similar soils in Michigan, where the soil has been found especially adapted to onions, cabbage, peppermint, and celery, has been described by the Bureau.² The application of potassium salts, after drainage, as a temporary corrective on these soils, has proved effective, as reported by several investigators, and the Indiana station reports that straw was nearly as effective. Chemical analyses³ by the usual method of digestion with concentrated hydrochloric acid have generally shown that these soils contain what would normally be considered ample quantities of lime, large quantities of phosphoric acid, and very large quantities of nitrogen. The amounts of potash usually reported are rather below what is obtained from productive soils. A thorough aeration and ventilation of these soils, which can be obtained by cultivation and underdrainage, would probably make them very valuable in the course of a few years, though possibly not immediately so.

No mechanical analysis of this type is given, since it is made up almost entirely of organic matter.

MEADOW.

In this report Meadow is a term used to indicate the poorly drained areas adjacent to water courses or lands subjected to overflow or seepage, irrespective of soil texture or vegetation. The Meadow occupies only about 4 per cent of the area of the county. It now forms a portion of the permanent pastures, but with the establishment of better drainage it can be made to produce a good quality of hay.

¹ Purdue University Agricultural Experiment Station, Unproductive Black Soils, Bulletin No. 95, Vol. XII, March, 1903; Lafayette, Ind.

² U. S. Department of Agriculture, Field Operations of the Bureau of Soils, 1901. Soil Survey of Allegan County, Mich., by Elmer O. Flippin and Thomas D. Rice; p. 118.

AGRICULTURAL DEVELOPMENT AND CONDITIONS.

In 1818 the Delaware Indians, who occupied a portion of the county, by the treaty of St. Marys ceded their territorial rights to the United States, and in 1823 withdrew from the county. At this time Madison County was organized from Marion County. The first permanent settlement in the county, however, antedated its organization about five years, having been made in Fall Creek Township in 1818. The early settlers came from Virginia and Kentucky. They found the county heavily timbered, with large tracts of poorly drained lands. The original timber growth consisted of oak, ash, walnut, hickory, and sugar maple. The first town to be founded was Pendleton, followed by Anderson and Chesterfield. The county did not grow very rapidly, being outside the line of travel, but with the building of railroads, between 1851 and 1891, the county made great strides and its progress has continued rapid to the present time.

Madison County is now one of the most prosperous counties of Indiana. There are three incorporated cities within its boundaries, and the total population is over 70,000. The manufacturing and agricultural interests are in a flourishing condition, presenting a wide range of industrial pursuits, and supplementing each other in the general development of the county. The great growth of manufacturing interests is attributable to the discovery of gas and oil, the use of which lessens the cost of production and enables the manufacturers more easily to compete with kindred industries.

The chief agricultural interest is stock raising. This is carried on in connection with general farming. Some roughage and grain are sold direct to local buyers, but the more enterprising farmers convert a great part of their field crops into beef or other meats.

The stock consists of horses, mules, cattle, sheep, and swine. Large numbers of horses are raised, more particularly in the southern part of the county. These are chiefly road and draft types, grade mares being bred to Percheron, Clydesdale, English Shire, and trotting stallions. The few mules raised are used mostly to supply the local demand for work animals of this type. The cattle are raised for dairy and beef purposes. The dairy cattle are few in comparison with the beef cattle, and consist of Jerseys and Holsteins. The dairy herds are usually found in the neighborhood of cities or large towns where dairy products can be readily disposed of. The beef cattle consist of graded Shorthorns and Here-

fords, the former predominating. Some herds of 25 or 30 cows are kept to produce beef calves, although the greater number of calves in the county are raised by farmers with only two or three cows. These animals, when matured, are either fattened by the owner or are bought up by farmers who make a business of feeding. A great number of young steers are imported from areas which have large tracts of cheap pasture lands. These are turned out on the pastures and during the fall and winter fattened on corn or ensilage. The latter is not used extensively at present, but its use is growing constantly. The hogs consist of graded Poland-China, Berkshire, Chester White, and Duroc-Jersey. The first and the last are most numerous. There are few pure-bred hogs in the county, but the graded stock is very good. Hogs form the main product of many of the farms and consume the greater part of the corn produced in the area.

Sheep are very scarce, but those seen consist of good grades, with a predominance of Shropshire blood. The farmers in general favor the grades and crosses, as they are considered more hardy than the pure-bred animals.

The farm houses of the area are usually two-story frame structures of very simple design. The outbuildings consist of a large barn, a corn crib, and a shelter for stock. The barns are mostly of the large, rectangular type, though "bank" barns are gradually displacing the older ones, owing to their better facilities for storing and feeding the crops. There are a few round barns, and these are generally regarded as the best type, considering economy of space and cost of construction. The cattle sheds are commonly of the straw type. The timbers are put up and the wheat straw blown over them from the thrashing machine.

The best general conditions in the area are found in the vicinity of Pendleton, west and north toward Anderson, and then east; and also in the vicinity of Alexandria, Elwood, and Summitville. The worst conditions occur on the poorly drained areas, more particularly on the areas of Miami black clay loam.

The farms are usually well fenced, and equipped with improved types of modern machinery. Insufficient care is given these tools, and they are often left exposed to the weather throughout the winter.

The farms vary greatly in size. There are 71 farms of less than 3 acres, and only 1 of over 1,000 acres. There are 1,090 farms containing between 50 and 100 acres, and 705 containing between 100 and 175 acres. The average size for all farms in the county is

81.9 acres. The value of the farm lands ranges from \$60 to \$100 an acre, depending upon location and improvements.

Of the 3,346 farms in Madison County, as given by the Twelfth Census, more than half are operated by the owners. About one-third are cultivated by tenants, by far the greater number of which are share tenants. On the share basis the owner receives one-half the crops, the tenant furnishing the seed. The cash rental ranges from \$2 to \$6 an acre. The leases are usually made out for periods of from one to five years. Landlords prefer the system of crop rent, as the tenant in this case usually takes better care of the land.

Farmers usually have considerable trouble in securing help during harvest, but the character of the labor employed is reliable and efficient. The use of labor-saving machinery has cut down the number of hands required, and very few men are now employed by the year, the farmers doing most of their own work, often exchanging service with others in the same community. Where labor is hired by the month or year, \$20 a month is a fair average wage, while during harvest from \$1.50 to \$2.50 a day is the customary rate.

The farming practiced in Madison County is of a general character, and there has been little development of special interests. This is one result of the remarkably uniform soil areas. The crops produced consist of corn, wheat, oats, and grass, and a very limited quantity of truck and orchard products.

Corn is the main crop, and the production is large, but little of it goes to the markets, the greater part being converted into beef and pork. Some corn is raised for ensilage and used largely for fattening cattle. There are few silos in the county, but to judge from interviews with farmers using them, they would seem to be a profitable investment.

The larger part of the wheat and oats is sold as soon as thrashed, small quantities being retained for home use.

Of the hay crops, clover seems to be the most important. The feeding and manurial value of the hay, combined with the low selling price, as compared with timothy, causes the use of large quantities of it as a stock feed in this area. The second cutting of clover is harvested for seed.

As already stated, there are in the area surveyed four types of soil, not including the lands grouped as Meadow. To emphasize some of the more salient features and adaptations of these different types, a brief review will be given here.

The Miami clay loam has the greatest area and is used almost

entirely for the production of grass and grain. It produces fair crops of corn, wheat, and hay, although oats do not do so well as on the Miami black clay loam. In the description of this type it was pointed out that little systematic rotation of crops was practiced, and it is not surprising that there has been a marked decrease in the yields, the result of continued cropping to corn and wheat. The type is generally deficient in organic matter, and there are many local spots in need of drainage.

It is suggested that the productiveness of this type would be increased by the practice of a judicious rotation, the establishment of better drainage, and the incorporation of humus through the use of stable manure and green manuring crops. In many places the application of lime would be most beneficial, more particularly in the depressions where the soil is cold and wet. The Miami clay loam is well adapted to the field crops at present grown. It also produces a good quality of apples, pears, and grapes, which, though now grown only to a limited extent, might be made an important feature of the agriculture on this type.

The type Muck, commonly known as "black prairie," or "chaffy soil," is a peculiar type of soil. With the ground water very near the surface, the soil is never too wet to work. It is apparently very rich, and yet at present largely unproductive; so much so that stable manure and wood ashes are necessary to produce profitable crops.

The most noticeable feature of this type is its poor underdrainage. The impervious nature of the underlying subsoil keeps the water table too near the surface, as a general rule. Better drainage could be established with a system of tile drains, provided the main ditch (Prairie Creek) be lowered, which seems practicable. In areas where the valley slopes are steeper and there is good natural drainage, the type is well adapted to corn and timothy. In such positions, also, this is a good soil for growing the general truck crops, particularly celery, onions, potatoes, and cabbage. In some parts of the United States very similar soils are used in the production of peppermint.

The relatively low productiveness of the Muck, as has been stated, is largely due to imperfect drainage, which has prevented aeration and consequent oxidation of the organic matter forming the greater proportion of the soil materials. In addition to a more thorough draining the process of oxidation can be hastened by incorporating strawy manures or litter, and this can best be added to the soil by the use of disk plows or harrows.

The Madison loam occupies the least area of the soils of the county. It is well adapted to light farming and the production of general truck and fruit crops, for which it is largely used at present.

The Miami black clay loam, under good general conditions, is more productive than the Miami clay loam. The production of oats is more successful on this type than on the Miami clay loam, although wheat does not do so well.

In Madison County the question of drainage is very important. Those areas of Madison loam which are subject to seepage from the bluffs could be greatly improved by a tile or open drain paralleling the bluffs. Reference has already been made to the drainage of the Muck areas. On the Miami black clay loam and Miami clay loam there is room for extension of the present drainage systems. Tile drains are, on the whole, most satisfactory, but frequently surface ditching to the underlying gravel is possible and answers very well. In some instances the kettle holes and small depressions have been drained by placing 6-inch tile in abandoned gas wells, where the pipes have been removed. It has been necessary to tile these wells only to the underlying gravel.

The use of commercial fertilizer is not very common in Madison County. The census report of 1900 gives \$5,730 as the total expenditure in the county for that purpose. In general, the only attempt to maintain the productiveness of the soils is made by turning under clover and timothy sod or worn-out pastures. The intervals between such renovation are in general too long.

A growing custom is that of feeding the cattle around the straw piles and saving the barnyard manure, a great deal of which formerly went to waste. It was not uncommon to see from three to six straw stacks around the barns on the best improved farms.

There was formerly an extensive system of toll roads in Madison County. The last of the companies operating these roads was bought out in 1889. At the present time the county owns 450 miles of well-kept turnpikes. In addition to these there is a complete system of dirt roads.

The railroad facilities of the county are excellent, many trunk lines traversing it in all directions. There is no part of the county where the distance to the nearest railroad exceeds 8 miles.

With the exception of manufactured products, cattle form the chief export of the county. They are shipped mainly to Chicago and Indianapolis, although some shipments go to Eastern markets.